BOOMERANG

This patent application is a nation stage application under 35 U.S.C. §371 of international application PCT/VN2008/000004, filed on Oct. 9, 2008, which claims priority to Vietnamese patent application number 1-2007-02103, filed on Oct. 12, 2007, the entire contents of which are hereby incorporated by reference in their entireties.

TECHNICAL FIELD

The present invention relates to a boomerang having a round ring with blades inside that can fly by means of a launching force and then can fly back to its launching position. More specifically, this invention relates to a boomerang that can automatically change both the elevation angle of the blades and the curve radius of the blades upon the change of rotary speed of the blades thanks to a special construction shape of the blades as well as the material of which the blades are made.

BACKGROUND ART

There have been many flying toys having rotor which can fly by means of receiving a rotary movement that makes the rotor spin around its center. Such a flying toy has been disclosed in U.S. patent application No. US2002098768 A1 (published on Jul. 25, 2002, inventors: KUO YIN JYH (TW); YANG HSIN-HAO (TW)). Since the rotor of that toy has its blades with fixed elevation angle, so when receiving rotary movement generally with a very high angular speed at the beginning caused by a launcher, the rotor will be effected by a very high lift force that rapidly increases the height of said rotor too much. Concurrent with such a high lift force, an air-drag force effecting on the blades of the rotor is high too, that results in decreasing the rotary speed of the rotor. As a result, the lift force rapidly decreases that in turn makes the rotor fall down. That means the flying rotors having blades with fixed elevation angle will have their flying time relatively short that decreases the amusement effect to players. Moreover, since the flying time of such a flying rotor is too short, so the rotor has not time enough for flying back to its launching position, so-called "boomerang effect". That further decreases the amusement effect to players.

To overcome the above said problem, some flying toys have recently been developed in the way of changing an elevation angle of the blades according to their rotary speed: reducing the elevation angle of the rotary blades when the rotary speed is high, and increasing the elevation angle of the rotary blades when the rotary speed is low that keeps a sufficient flying time without increasing a flying height too much. Example of such a flying toy has been disclosed in Japanese patent application No. JP2005152090 (published on Jun. 16, 2005, inventor: Masui Hikari (JP)).

However, these toys seem relatively complicated; they need an elevation angle control means for changing the angle according to the rotary speed of the blades.

Therefore, there is still a need for developing flying rotor having blades with changeable elevation angle upon the change of rotary speed of the blades, but with very simple construction, in particular the elevation angle can automatically be changed upon the change of the rotary speed of the blades without any control means.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to provide a boomerang having blades that can automatically

change their elevation angle and their curve radius upon the change of rotary speed of the blades thanks to a special construction of the blade shape as well as type of material of which the blades are made.

In accordance with the present invention, a boomerang of the invention launched by a hand-held launcher comprises:

- a center part having a round perimeter, its bottom side provides means for attaching the upper part of hand-held launcher so that said boomerang can receive rotary movement created by said hand-held launcher,
- blades made of elastically plastic films, being evenly distributed about and radially extending from center part, said blades have an elevation angle α_0 of from about 10° to about 45°, an extreme inner end having a rear groove and a front groove; and

a ring having its inner perimeter mounted with extreme outer ends of said blades, said extreme outer ends have a rear groove and a front groove, wherein said blade have their curve radius longer or equal to 1/5 of radius of said ring, the ratio between the width d_1 of extreme outer ends and blade width is of from about 1/6 to about 6/7, the ratio between the width d_2 of extreme inner ends and blade width is of from about 0 to about 6/7, and the total area of said blades is of from about 10 to about 40% of the area of a circle defined by said ring.

On the flying principle, a system of blades with an elevation angle α moving in a medium like air will be exerted by an external force system as shown in FIG. **5***a*. The nature of the force system exerting on the moving blades is equivalent to a mechanical system as shown in FIG. **5***b*, i.e. it consists of two variable forces as drag force F_d (in the direction opposite to the blade's motion) and lift force F_l (in the direction opposite to the direction of gravity force). The sum of these two forces is force F perpendicular to the plane of the blades, that causes a moment $M=F\cdot d$, wherein force F is the sum of drag force F_d and lift force F_l, d is the distance between spin center O and the position of the force F. When the speed of the blades is unchanged, the two variable forces F_d and F_l are in direct proportion to the elevation angle α. When the elevation angle α is unchanged, then the two variable forces F_d and F_l shall be in direct proportion to the speed of the blades. These variations are shown FIG. **7**.

If the blades are made of an elastic material, then beside the above mentioned forces, the moving blades are still exerted by elastic force F_e perpendicular to the plane of the blades and in the down direction that causes elastic moment $M_e=k\cdot\beta$, wherein k is elastic coefficient of the blades, depending on the material for making blades, the size and the relative position of the two blade ends to the blade, β is a change of elevation angle caused by moment M.

Accordingly, a boomerang having blades made of light and elastic material with a given parameter combination of initial elevation angle α_0, elastic coefficient of blades k, size and relative position of the two ends shall be capable of self adjusting the elevation angle α of its blades according to the speed of its blades, that means the lift force F_l and the drag force F_d shall automatically be adjusted according to the change of blade speed.

Therefore, the initial elevation angle α_0, elastic coefficient of blades k and initial curve radius of blades r_0 can be chosen in such way that different functions as shown in the two following models can be obtained:

Model 1: when v (blade speed) increases, then α decreases, blades curve radius r increases, F_l and F_d decrease; and on the contrary when v decreases, then α increases, r decreases, F_l and F_d increase. This creates an unexpectedly desirable effect in that the lift force is in inverse